REMARKS

Cancelled Claims

By this amendment, claims 3, 4, 12, and 17 have been cancelled.

Allowable Subject Matter

The Office Action indicated that claims 2, 4-5, 7-8, 10, and 17-21 would be allowable if rewritten in independent form, including all of the limitations of the base claim and any intervening claims. Claim 1 has been rewritten to include the limitations of allowable claim 4, and intervening claim 3. Claims 6, 9, 22-24, and 26 depend from allowable claim 1, either directly or indirectly. Allowable claims 2, 5, 7-8, and 10 have been rewritten in independent form. Claim 14 has been amended to include the limitations of allowable claim 17. Claims 15-16 depend from allowable claim 14, either directly or indirectly. Claims 18-19 have been rewritten into independent form. Claims 20-21 depend from allowable claim 19. Newly added claim 27 includes features similar to allowable claim 8. Accordingly, claims 1-2, 5-10, 14-16, 18-24, and 26-27 are in condition for allowance.

Claim Rejections

Claim 1 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Miki (JP 3-175800). Claims 1, 3, 6, 9, 11, 13 and 22-24 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Kishi (U.S. Patent No. 4,654,554). Claim 12 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kishi in view of Barr (U.S. Patent No. 5,161,200). Claim 14 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Rapps et al. (U.S. Patent No. 5,446,332) in view of Massa (U.S. Patent No. 2,427,062). Claims 14 and 15 stand rejected under 35 U.S.C. § 103(a) as being anticipated by Miki. Claim 16 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Miki and Massa in view of Kitanishi (U.S. Patent No. 5,321,761). Claim 25 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Miki. Claim 26

stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Miki in view of Knecht (U.S. Patent No. 5,577,319).

As indicated above, claim 1 has been rewritten to include the limitations of allowable claim 4, and intervening claim 3. Accordingly, claim 1 is in condition for allowance. Claims 6, 9, 22-24, and 26 depend from allowable claim 1, either directly or indirectly. Thus, claims 6, 9, 22-24, and 26 are also in condition for allowance.

As indicated above, claim 14 has been rewritten to include the limitations of allowable claim 17. Accordingly, claim 14 is in condition for allowance. Claims 15-16 depend from allowable claim 14, either directly or indirectly. Thus, claims 15-16 are also in condition for allowance.

Claim 11

As indicated above, claim 11 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Kishi. Claim 11 has been amended to include the features of cancelled claim 12. Claim 12 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kishi in view of Barr. It is respectfully submitted, however, that claim 11, as amended, is patentable over the art of record for the reasons set forth below.

Applicants' invention, as recited by amended claim 11, includes a feature that is neither disclosed nor suggested by the art of record namely:

> a support element for supporting the piezoelectric vibrator at a substantial center of the piezoelectric vibrator...the support element including a conductive portion in electrical contact with the piezoelectric vibrator, and an electrical input is applied to the piezoelectric member via the conductive portion, causing the piezoelectric vibrator to vibrate.

This means that the piezoelectric loudspeaker (10) recited in claim 11 includes a support element (22) for supporting a piezoelectric vibrator (3). The

support element (22) includes a conductive portion. The conductive portion of the support element (22) is in electrical contact with the piezoelectric vibrator (3). An electrical input is applied, via the conductive portion of the support element (22), to a piezoelectric member included as part of the piezoelectric vibrator (3). As a result, the piezoelectric element vibrates. These features are supported by the originally filed application at page 31, lines 7-17. No new matter has been added.

Kishi discloses a piezoelectric speaker that includes a plurality of vibrating elements (see abstract). Kishi discloses using a sponge pad (damper pad 16) between the weight 8 and the bottom face of the outer case (see column 6, lines 35-40, and figures 6a and 6b); however, Kishi makes no mention whatsoever regarding the pad (16) supporting the piezoelectric vibrator. As such, the pad 16 is very different from the support element recited in claim 11 of the present application.

Barr discloses a microphone including elements having a mass which can affect the output of the microphone (see abstract). The microphone (10) disclosed in Barr includes a connecting wire (18) for receiving electrical output from the sensor (14) included in the microphone (not a loudspeaker) (see column 4, lines 12-29 and figure 1). Electrical input is not applied to the sensor (14), and as such, the sensor is very different from the conductive portion of the support element recited in claim 11 of the present invention which is used to transmit the electrical signal to the piezoelectric member.

Therefore, even by combining Kishi and Barr, Applicants' piezoelectric loudspeaker, as recited by claim 11, is not achieved.

It is because Applicants include the above-recited features with respect to claim 11, that the following advantages are achieved. By providing an at least partially conductive support element, and applying an electrical input to the conductive portion of the support element, an excessive amplitude occurring in the central portion of the piezoelectric vibrator can be minimized. This results in an improved withstand input level, further resulting in a reduction in the number of lead wires, thereby reducing the likelihood of malfunction, and improving the production yield (see originally filed application at page 42, lines 10-18). Further, the piezoelectric loud speaker has a high sound volume level and flat reproduced

sound volume frequency characteristics (see originally filed application at page 41, lines 12-26).

Accordingly, for the reasons set forth above, claim 11 is patentable over the art of record. Claim 13 includes all of the features of claim 11, from which it depends. Thus, claim 13 is also patentable over the art of record for the reasons set forth above.

Claim 25

As indicated above, Claim 25 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Miki. It is respectfully submitted, however, that claim 25, as amended, is patentable over the art of record for the reasons set forth below.

Applicants' invention, as recited by amended claim 25, includes a feature that is neither disclosed nor suggested by the art of record namely:

> ...the visco-elastic member covering an entire upper face of the piezoelectric member.

This means that the piezoelectric loudspeaker recited in claim 25 includes a visco-elastic member (5) provided on at least one face of the piezoelectric loudspeaker (10). This visco-elastic member (5) covers an entire upper face of a piezoelectric member included as a part of the piezoelectric vibrator. This feature is disclosed in the originally filed application at Figure 36A of the present application. No new matter has been added.

Miki discloses a piezoelectric speaker with an expanded low frequency reproduction capability (abstract). Miki discloses the mass member (6) being smaller than the piezoelectric ceramic plate (1). As such, the mass member (6) in Miki cannot cover an entire upper face of the piezoelectric ceramic plate (1). As such, Miki is in direct contrast to claim 25 of the present application in which the visco-elastic member covers an entire upper face of the piezoelectric member.

Accordingly, for the reasons set forth above, claim 25 is patentable over the art of record.

Newly added claim 27 includes features similar to allowable claim 8. Accordingly, newly added claim 27 is in condition for allowance.

Accordingly, for the reasons set forth above, the above-identified application is in condition for allowance which action is respectfully requested.

Respectfully Submitted,

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Version with markings to show changes made
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

CLAIMS

1. (As Amended) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

[wherein] the visco-elastic member [is] being disposed in a substantial center of the piezoelectric vibrator, [and]

[wherein] the visco-elastic member [has] having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the visco-elastic member comprising first and second visco-elastic members provided on opposite sides of the piezoelectric vibrator, and

the first and second visco-elastic members comprising different materials or different shapes.

2. (As Amended) [A piezoelectric loudspeaker according to claim 1,

wherein] A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the visco-elastic member [comprises] including two or more visco-elastic members stacked on top of each other, and

[wherein] the two or more [types of] visco-elastic members [at least comprise] comprising different materials or different shapes.

5. (As Amended) [A piezoelectric loudspeaker according to claim 1,

wherein] A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the visco-elastic member [comprises] comprising two or more visco-elastic members having mutually different values in at least one of specific gravity, Young's modulus, and internal loss, and

[wherein] the two or more [types of] visco-elastic members are disposed in a concentric manner.

7. (As Amended) [A piezoelectric loudspeaker according to claim 1,

wherein] A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm, and

the piezoelectric vibrator [has] having at least one aperture, the at least one aperture being at least partially filled by the visco-elastic member.

8. (As Amended) [A piezoelectric loudspeaker according to claim 1,

wherein] A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the frame [has] having a horn-like configuration [having] including an opening, the opening having a gradually increasing cross-sectional area away from the piezoelectric vibrator and toward a final opening at which soundwaves are emitted, and

[wherein] the visco-elastic member [has] having a conical configuration having a gradually decreasing cross-sectional area away from the piezoelectric vibrator and toward the final opening.

10. (As Amended) [A piezoelectric loudspeaker according to claim 1, wherein] A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the visco-elastic member [includes] including notches in at least [in] one portion thereof.

11. (As Amended) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a support element for supporting the piezoelectric vibrator at a substantial center of the piezoelectric vibrator,

the support element including a conductive portion in electrical contact with the piezoelectric vibrator, and an electrical input is applied to the piezoelectric member via the conductive portion, causing the piezoelectric vibrator to vibrate.

14. (As Amended) A piezoelectric loudspeaker comprising:

[a voltage applying means for applying a plurality of voltages;]

a piezoelectric vibrator including a diaphragm and a plurality of piezoelectric members provided on at least one face of the diaphragm, the diaphragm being vibrated by the plurality of piezoelectric members; and

a frame for supporting the piezoelectric vibrator,

wherein different voltages are applied to at least two of the plurality of piezoelectric members [have a different voltage applied thereto from the voltage applying means], and

the plurality of piezoelectric members being defined by at least two split sections of the visco-elastic member provided on at least one face of the piezoelectric vibrator.

18. (As Amended) [A piezoelectric loudspeaker according to claim 14, further comprising] A piezoelectric loudspeaker comprising:

a voltage applying means for applying a plurality of voltages;

a piezoelectric vibrator including a diaphragm and a plurality of piezoelectric members provided on at least one face of the diaphragm, the diaphragm being vibrated by the plurality of piezoelectric members;

a frame for supporting the piezoelectric vibrator;

wherein at least two of the plurality of piezoelectric members have a different voltage applied thereto from the voltage applying means; and

an electrically resistant element for interconnecting at least two of the plurality of piezoelectric members.

19. (As Amended) [A piezoelectric loudspeaker according to claim 1 further comprising] A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator;

a visco-elastic member provided on at least one face of the piezoelectric vibrator, the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator, and the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm; and

a plate for connecting at least one said visco-elastic member to the frame so as to damp unwanted vibration of the piezoelectric vibrator, [wherein] an enclosed space [is] being formed by the plate, the frame, and the diaphragm.

25. (As Amended) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

[wherein] the visco-elastic member [is] being disposed in a substantial center of the piezoelectric vibrator,

[wherein] the visco-elastic member [has] having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm, [and]

[wherein] the bottom face area of the visco-elastic member is equal to or greater than the bottom face area of the piezoelectric member, and a diameter of the visco-elastic member is smaller than the inner diameter of the frame, and

the visco-elastic member covering an entire upper face of the piezoelectric member.

Claims 3, 4, 12 and 17 are cancelled.

Claim 27 is newly added.